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SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 11, 1887.

THE STUDY OF GEOGRAPHY.

IT is a remarkable fact, that, in the recent literature of geography, researches on the method and limits of that science occupy a prominent place. Almost every distinguished geographer has felt the necessity of expressing his views on its aim and scope, and of defending it from being disintegrated and swallowed up by geology, botany, history, and other sciences treating on subjects similar to or identical with those of geography. If the representatives of a science as young as geography spend a great part of their time in discussions of this kind, though the material for investigations is still unlimited; if they feel compelled to defend their field of research against assaults of their fellow-workers and outsiders, — the reason for this fact must be looked for in a deep discrepancy between their fundamental views of science and those of their adversaries.

Formerly, when the greater part of the earth's surface was undiscovered, and European vessels sailed only over their well-known routes from continent to continent, careful not to stray from the old path and fearing the dangers of unknown regions, the mere thought of these vast territories which had never been sighted by a European could fill the mind of geographers with ardent longing for extended knowledge; with the desire of unveiling the secrets of regions enlivened by imagination with figures of unknown animals and peoples. But the more completely the outlines of continents and islands became known, the stronger grew the desire to *understand* the phenomena of the newly discovered regions by comparing them with those of one's own country. Instead of merely extending their study over new areas, scientists began to be absorbed in examining the phenomena more intently, and comparing them with the results of observations already made. Thus Humboldt's admirable works and Karl Ritter's comparative geography arose out of the rapidly extending knowledge of the earth.

The fact that the rapid disclosure of the most remote parts of the globe coincided with the not less rapid development of physical sciences has had great influence upon the development of geography; for while the circle of phenomena became wider every day, the idea became prevalent that a single phenomenon is not of great avail, but that it is the aim of science to deduce laws from phenomena; and the wider their scope, the more valuable they are considered. The descriptive sciences were deemed inferior in value to researches which had hitherto been outside their range. Instead of systematical botany and zoölogy, biology became the favorite study; theoretical philosophy was supplanted by experimental psychology; and, by the same process, geography was disintegrated into geology, meteorology, etc.

Ever since, these sciences have been rapidly developed, but geography itself has for a long time been almost overshadowed by its growing children. However, we do not think they can fill its place, and wish to prove that its neglect cannot be remedied by the attentive cultivation of those sciences separately.

Those accustomed to value a study according to the scope of the laws found by means of it are not content with researches on phenomena such as are the object of geography. They consider them from a physical stand-point, and find them to be physical, meteorological, or ethnological; and, after having explained them by means of physical, physiological, or psychological laws, have finished their work. It is very instructive to consider thoroughly their definition of geography. They declare that the domain of this science comprises neither magnetical and meteorological nor geological phenomena and processes. They generously grant it the study of the distribution of animals and plants, as far as physiologists and evolutionists will permit; but all agree that anthropo-geography — the life of man as far as it depends on the country he lives in — is the true domain of geography.

It is not difficult to discover the principle on which this segregation is founded. Physical phenomena are subject to physical laws which are known, or which will assuredly be found by the methods used in discovering those that are known. Physiological, and, to a still higher degree, psychological, laws are not so well known as to allow their being treated in the same way as physical laws. The conditions of the phenomena are generally so complicated, that, even if the most general laws were known, a strict conclusion cannot easily be drawn. But were those auxiliary sciences just as far developed as physics, no doubt the same scientists who at the present time concede them willingly to geography would not hesitate to claim them for physiology and psychology. It

is evident that there is no middle way: geography must either be maintained in its full extent or it must be given up altogether.

As soon as we agree that the purpose of every science is accomplished when the laws which govern its phenomena are discovered, we must admit that the subject of geography is distributed among a great number of sciences; if, however, we would maintain its independence, we must prove that there exists another object for science besides the deduction of laws from phenomena. And it is our opinion that there *is* another object, — the thorough understanding of phenomena. Thus we find that the contest between geographers and their adversaries is identical with the old controversy between historical and physical methods. One party claims that the ideal aim of science ought to be the discovery of general laws; the other maintains that it is the investigation of phenomena themselves.

It is easily understood, therefore, why in geography the contest between these views is particularly lively. Here naturalists and historians meet in a common field of work. A great number of modern geographers have been educated as historians, and they must try to come to an agreement with the naturalists, who, in turn, must learn to accommodate their views to those of the historians. It is evident that an answer to this fundamental question on the value of historical and physical science can only be found by a methodical investigation of their relation to each other.

All agree that the establishment of facts is the foundation and starting-point of science. The physicist compares a series of similar facts, from which he isolates the general phenomenon which is common to all of them. Henceforth the single facts become less important to him, as he lays stress on the general law alone. On the other hand, the facts are the object which is of importance and interest to the historian. An example will explain our meaning more satisfactorily than a theoretical discussion.

When Newton studied the motion of the planets, the distribution of those celestial bodies in space and time were the means, not the object, of his researches. His problem was the action of two bodies upon each other, and thus he found the law of gravitation. On the other hand, Kant and Laplace, in studying the solar system, asked the question, Why is every one of the bodies constituting the solar system in the place it occupies? They took the law as granted, and applied it to the phenomena from which it had been deduced, in order to study the history of the solar system. Newton's work was at an end as soon as he had found the law of gravitation, which law was the preliminary condition of Kant's work.

Here is another example: according to Buckle's conception, historical facts must be considered as being caused by physiological and psychological laws. Accordingly, he does not describe men and their actions as arising from their own character and the events influencing their life, but calls our attention to the laws governing the history of mankind. The object of the historians is a different one. They are absorbed in the study of the facts, and dwell admiringly on the character of their heroes. They take the most lively interest in the persons and nations they treat of, but are unwilling to consider them as subject to stringent laws.

We believe that the physical conception is nowhere else expressed as clearly as in Comte's system of sciences. Setting aside astronomy, which has been placed rather arbitrarily between mathematics and physics, all his sciences have the one aim, to deduce laws from phenomena. The single phenomenon itself is insignificant: it is only valuable because it is an emanation of a law, and serves to find new laws or to corroborate old ones. To this system of sciences Humboldt's 'Cosmos' is opposed in its principle. Cosmography, as we may call this science, considers every phenomenon as worthy of being studied for its own sake. Its mere existence entitles it to a full share of our attention; and the knowledge of its existence and evolution in space and time fully satisfies the student, without regard to the laws which it corroborates or which may be deduced from it.

Physicists will acknowledge that the study of the history of many phenomena is a work of scientific value. Nobody doubts the importance of Kant's researches on the solar system; nobody derogates from that of investigations upon the evolution of organisms. However, there is another class of phenomena the study of which is not considered of equal value, and among them are the geographical ones. In considering the geography of a country, it seems that the geological, meteorological, and anthropo-geographical phenomena form an incidental conglomerate, having no natural tie or relation to one another, while, for instance, the evolutionist's subject of study forms a natural unity. We may be allowed to say that the naturalist demands an objective connection between the phenomena he studies, which the geographical phenomena seem to lack. Their connection seems to be subjective, originating in the mind of the observer.

Accordingly there are two principal questions which must be answered: first, the one referring to the opposition between physicists and cosmog-

raphers, i.e., Is the study of phenomena for their own sake equal in value to the deduction of laws? second, Is the study of a series of phenomena having a merely subjective connection equal in value to researches on the history of those forming an objective unity?

We shall first treat on the difference of opinion between physicists and cosmographers. The two parties are strongly opposed to each other; and it is a hard task to value justly the arguments of opponents whose method of thinking and way of feeling are entirely opposed to one's own. An unbiassed judgment cannot be formed without severe mental struggles which destroy convictions that were considered immovable, and had become dear to us. But those struggles lead to the grander conviction that both parties, though in a permanent state of conflict, aspire to the same end, — to find the eternal truth.

The origin of every science we find in two different desires of the human mind, — its aesthetic wants, and the feelings, which are the sources of the two branches of science. It was an early desire of developing mankind to arrange systematically the phenomena seen by the observer in overwhelming number, and thus to put the confused impressions in order. This desire must be considered an emanation of the aesthetical disposition, which is offended by confusion and want of clearness. When occupied in satisfying this desire, the regularity of the processes and phenomena would attain a far greater importance than the single phenomenon, which is only considered important as being a specimen of the class to which it belongs. The clearer all the phenomena are arranged, the better will the aesthetic desire be satisfied, and, for that reason, the most general laws and ideas are considered the most valuable results of science.

From this point of view, the philosophical ideas of Epicurus are very interesting, as they may be considered the extreme opinion to which this aesthetical desire can lead if the pleasure one enjoys in arranging phenomena in a clear system is the only incentive. He considered any explanation of a phenomenon sufficient, provided it be natural. It does not matter, he taught, if an hypothesis is true, but all probable explanations are of the same value, and the choice between them is quite insignificant. We believe this opinion is called to a new life by a number of modern scientists, i.e., by those who try to construct the evolution of organisms in details which, at the present time at least, can neither be proved nor refuted. If, for instance, Müller describes the history of the evolution of flowers, he gives only a probable way of development, without any better proof than that it seems to be the simplest and therefore the most probable. But this construction of a probable hypothesis as to the origin of these phenomena gives a satisfaction to our aesthetical desire to bring the confusion of forms and species into a system. But it should be borne in mind that a theory must be true, and that its truth is the standard by which its value is measured. Therefore naturalists are always engaged in examining the truth of their theories by applying them to new phenomena, and in these researches those phenomena are the most important which seem to be opposed to the theories. As soon as the question whether the theory is applicable to the class of phenomena is solved, the whole class is of little further interest to the investigator.

While physical science arises from the logical and aesthetical demands of the human mind, cosmography has its source in the personal feeling of man towards the world, towards the phenomena surrounding him. We may call this an 'affective' impulse, in contrast to the aesthetic impulse. Goethe has expressed this idea with admirable clearness: "It seems to me that every phenomenon, every fact, itself is the really interesting object. Whoever explains it, or connects it with other events, usually only amuses himself or makes sport of us, as, for instance, the naturalist or historian. But a single action or event is interesting, not because it is explainable, but because it is true" (*Unterhaltungen deutscher Ausgewanderten*).

The mere occurrence of an event claims the full attention of our mind, because we are affected by it, and it is studied without any regard to its place in a system. This continuous impulse is the important counterbalance against the one-sidedness of a science arisen from merely aesthetic impulses. As the truth of every phenomenon causes us to study it, a true history of its evolution alone can satisfy the investigator's mind, and it is for this reason that Epicurus's probable or possible explanation is not at all satisfactory for science, but that every approach to truth is considered a progress by far superior to the most elaborate system which may give proof of a subtile mind and scrupulous thought, but claims to be only one among many possible systems.

Naturalists will not deny the importance of every phenomenon, but do not consider it worthy of study for its own sake. It is only a proof or a refutation of their laws, systems, and hypotheses (as they are deduced from true phenomena), which they feel obliged to bring as near the truth as possible. The deductions, however, are their main interest; and the reward of the indefatigable student is to review, from the summit of his most general deductions, the vast field of phenomena.

Joyfully he sees that every process and every phenomenon which seem to the stranger an irregular and incomprehensible conglomerate is a link of a long chain. Losing sight of the single facts, he sees only the beautiful order of the world.

The cosmographer, on the other hand, holds to the phenomenon which is the object of his study, may it occupy a high or a low rank in the system of physical sciences, and lovingly tries to penetrate into its secrets until every feature is plain and clear. This occupation with the object of his affection affords him a delight not inferior to that which the physicist enjoys in his systematical arrangement of the world.

Our inquiry leads us to the conclusion that it is in vain to search for an answer to the question, Which of the two methods is of a higher value? as each originates in a different desire of the human mind. An answer can only be subjective, being a confession of the answerer as to which is dearer to him, — his personal feeling towards the phenomena surrounding him, or his inclination for abstractions; whether he prefers to recognize the individuality in the totality, or the totality in the individuality.

Let us now turn to the discussion of the second point. We have seen that physicists are inclined to acknowledge the value of a certain class of cosmographical studies. It is the characteristic quality of those phenomena that they are the result of the action of incidental causes upon one group of forces, or upon the elements of phenomena. The physicist does not study the whole phenomenon as it represents itself to the human mind, but resolves it into its elements, which he investigates separately. The investigation of the history of these elements of phenomena leads to a systematical arrangement, which gives to the aesthetical desire as much satisfaction as the formulation of laws. The end which evolutional and astronomical researches tend to is the best proof of this fact. A study of groups of phenomena, which seem to be connected only in the mind of the observer, and admit of being resolved into their elements, cannot lead to a similar result, and is therefore considered of inferior value. However, we have tried to prove that the source of cosmographical researches is an affective one. If this be right, we cannot distinguish between complex and simple phenomena, as the physicist tries to do, and neglect their subjective unity, — the connection in which they appear to the mind of the observer. The whole phenomenon, and not its elements, is the object of the cosmographer's study. Thus the physiognomy of a country is of no interest to the physicist, while it is important to the cosmographer.

From the stand-point we occupy, a discussion as to the value of these researches is of just as little avail as that on the value of the two branches of science, for the judgment will be founded on the mental disposition of the judge, and be only a confession as to which impulse predominates, the aesthetic or the affective. However, one fact appears from our inquiry: cosmography is closely related to the arts, as the way in which the mind is affected by phenomena forms an important branch of the study. It therefore requires a different treatment from that of the physical sciences.

We will apply these results to the study of geography. Its objects are, the phenomena caused by the distribution of land and water, by the vertical forms of the earth's surface, and by the mutual influence of the earth and its inhabitants upon each other.

What does the physicist do with this object of study? He selects a single element out of phenomena which are observed at a certain point of the earth's surface, and compares it with another one found at another place. He continues in this way searching for similar phenomena, and loses sight altogether of the spot from which he started. Thus he becomes the founder of the sciences into which geography has gradually been resolved, as his studies are either directed to geological phenomena alone, or to meteorological, botanical, or whatever it may be. The most general deductions which can be reached in the pursuit of these studies still have a close connection with the single object, as they cannot be carried farther than to the most general geographical ideas, as mountain-ranges, running water, oceans, etc. The most general results of his investigations will therefore be a general history of the earth's surface. If he bring these results into a system, he acts, as it seems to us, against the cosmographical character of the science. For instance, a system of all possible actions of water as forming the earth's surface seems to us of little value, except from a practical stand-point as being useful in studying the geological history of a district or of the earth's surface. Therefore these systems must be considered as important auxiliary sciences, but they are not geography itself. Their value is founded only on their applicability to the study of geography. The invention of geographical systems, so far as they do not serve this purpose, must be considered as useless, and classifications must be made only as far as geographical phenomena of a similar kind must be explained by different causes.

But there is another branch of geography besides this, equal to it in value, — the physiognomy of the earth. It cannot afford a satisfactory ob-

ject of study to the physicist, as its unity is a merely subjective one; and the geographer, in treating these subjects, approaches the domain of art, as the results of his study principally affect the feeling, and therefore must be described in an artistic way in order to satisfy the feeling in which it originated.

Our consideration leads us to the conclusion that geography is part of cosmography, and has its source in the affective impulse, in the desire to understand the phenomena and history of a country or of the whole earth, the home of mankind. It depends upon the inclination of the scientist towards physical or cosmographical method, whether he studies the history of the whole earth, or whether he prefers to learn that of a single country. From our point of view, the discussion whether geology or meteorology belongs to geography is of little importance, and we are willing to call all scientists geographers who study the phenomena of the earth's surface. We give geology no preference over the other branches of science, as many modern scientists are inclined to do. The study of the earth's surface implies geological researches as well as meteorological, ethnological, and others, as none of them cover the scope of geography, to delineate the picture of the earth's surface.

Many are the sciences that must help to reach this end; many are the studies and researches that must be pursued to add new figures to the incomplete picture; but every step that brings us nearer the end gives ampler satisfaction to the impulse which induces us to devote our time and work to this study, gratifying the love for the country we inhabit, and the nature that surrounds us.

FRANZ BOAS.

ITALIAN MEDICAL PSYCHOLOGY.

THE study of the nervous system in health and disease has been assiduously cultivated in Italy for many years. The peculiar environment and volatile characteristics of the race may have been influential in drawing attention to the study of insanity.

Italian alienists have taken a deep interest in the psychological aspects of their specialty; and their main review, the *Rivista sperimentale di freniatria*, has been thriving for many years. A brief notice of a few of the articles contained in the last volume will serve to indicate some of the directions in which work is being carried on.

A frequent contributor to this review was the physiologist Buccola, who died last year. He has published a volume in the International scientific series which is devoted to an account of the experimental study of the time of psychic processes, and which merits an English translation. One of his latest researches is embodied in a long article in this review on the electric reaction of the acoustic nerve in the insane. If you place one of the poles in the external auditory chamber, and the other on the neck or the hand, besides causing slight pain, muscular contractions, etc., a distinct sound will be heard on closing the circuit if the negative pole is in contact with the ear, and on opening the circuit if it is the positive pole. This for the healthy ear. But in the insane this formula is sometimes reversed, and suffers irregularities. The examination of the auditory apparatus is thus of diagnostic value, especially in cases of auditory hallucinations. In almost all such cases the hearing is thus shown to be diseased, and in a few cases stimulation of the auditory nerve caused the hallucinations to appear.

Two observers, Tambroni and Algeri, contribute to this study of the psychic diagnosis of insanity an account of experiments upon the reaction times of the insane. After some preliminary training, the patient was subjected to eight tests of forty observations each. An observation consisted, 1°, in measuring the time necessary for the patient to feel the contact of a point; 2°, the time to perceive whether a single point or a pair of points 2.2mm. apart was drawn across the tip of his right forefinger. The paranoic patient reacts more quickly than the normal man; and in this is implied not only that he feels sooner, but knows what he feels more rapidly: it is a psychic hyperaesthesia. In all other forms of insanity the time of a simple reaction and of a distinction is lengthened when the normal time is .183 of a second; the time of the paranoic type is .174 of a second; of the maniacal, .312; of the demented, .344; of the epileptic, .362; of the melancholic (in whom all mental life is sluggish and monotonous), .374. Four persons of each type were examined. It takes slightly longer to perceive a double than a single point.

A very careful study on the effect of repetition of simple acts, that is, of practice, upon the time it takes to perform them, is rendered by Guicciardi and Cionini. They take as their basis three well-known laws regarding practice; viz., 1°, that it makes repetition easier (and quicker); 2°, that it does so at first more rapidly than later on; and, 3°, that a limit to this process is slowly reached. The original part of their work consists in showing that practice has greater abbreviating power in complicated than in simple acts. A simple touch reaction by the effect of 250 repetitions was shortened .018 of a second; the time for perceiving that but a single point was touching